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(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S–126 25 Stockholm (SE).

(72) Inventors: LIU, George, Yuejin; Skiftesvägen 49, S–187 31 Täby (SE). REHN, Hong; Bergshamer 71, S–170 44 Solna (SE).

(74) Agent: ERICSSON RADIO SYSTEMS AB; Common Patent Dept., S–164 80 Stockholm (SE).

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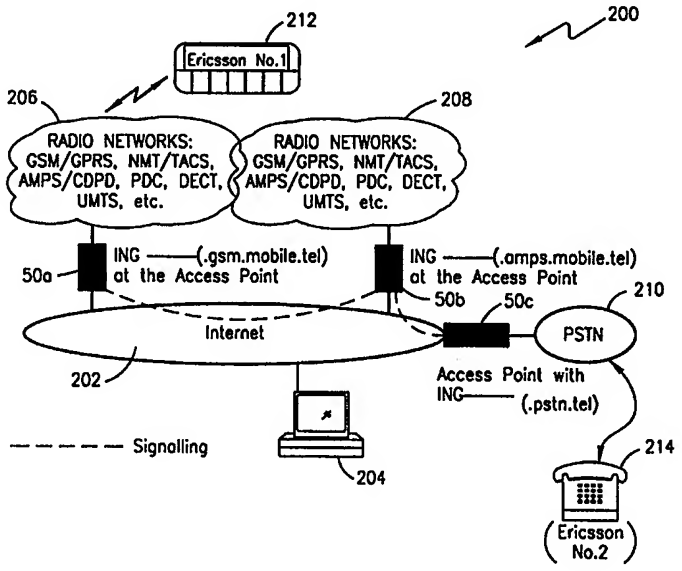
(54) Title: INTERNET ACCESS BY TELEPHONE



(57) Abstract

An IP–number router/gateway (50, 50a, 50b, and 50c) is disclosed, which functions as a distributed hierarchical name–matching and conversion global directory service database that enables mapping (16, 12, 33, 31, and 29) between telephone numbers (22) and IP addresses (18), telephone numbers (22) and device names (14), telephone numbers (22) and personal user names (28), and device names (14) and personal user names (28). The IP–number router/gateway (50, 50a, 50b and 50c) also functions as a router or gateway between the Internet (10 and 202) and telephone networks (20, 206, 208 and 210). Consequently, telephone numbers (22, 24 and 26) can be used as virtual IP addresses for supporting data communications between the Internet (10 and 202) and the telephone networks (20, 206, 208 and 210).

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INTERNET ACCESS BY TELEPHONE

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates in general to the telecommunications field and, in particular, to a method by which a mobile or fixed telephone can access the Internet without needing a special Internet address.

Description of Related Art

The continued exponential growth of the Internet has created a need for the development of new protocols, techniques and products for use in cellular/Internet accessing schemes. In today's growing technological environment, cellular network subscribers using both mobile and fixed telephones need to be able to readily access the Internet, corporate local area networks (LANs), intranets, and external public data networks.

One special communications protocol that represents a particularly important form of inter-networking technology is the Transmission Control Protocol/Internet Protocol (TCP/IP). TCP/IP is the basic communications language used by the Internet, which allows the tying of diverse types of networks together so that any networked computer can communicate with another. The IP layer of the TCP/IP controls the movement of packets around a network, from their source to their final destination. The TCP/IP requires each computer or other device (e.g., mobile or fixed telephone terminal) connected to the Internet to have an identifier, in order to communicate with any other computer or device in the Internet. As such, telephone numbers are used as unique identifiers for both mobile and fixed telephones in international telephone networks.

Currently, the following three types of identifiers are most commonly used in an Internet environment: (1) host names; (2) IP addresses; and (3) physical hardware addresses. Specifically, each device (computer or mobile/fixed telephone terminal) attached to the Internet is assigned a "host name" that contains 1 to 8

alphanumeric characters. The host name for a device is combined with a tree-structured domain name to form a unique name for that device (or host). That unique name can be used by users or application programs to identify that particular device (or host) anywhere in the Internet.

Each device attached to the Internet is also assigned at least one unique IP address (referred to as the "Internet address"). The Internet address for a device is typically either a 32-bit (IP-Version 4) or 128-bit (IP-Version 6) binary number that (in accordance with the IP) is used to uniquely identify, and route packets to, the connection point where the device is actually attached to the Internet. Furthermore, each device attached to a physical network in the Internet is also assigned a unique hardware address (referred to as the "station address"). Typically, a hardware address is assigned to a device when its network interface card (NIC) is manufactured. Different local networks may use different hardware address spaces. For example, some LANs may use 48-bit hardware addresses, while other LANs may use 16-bit hardware addresses.

A problem typically arises when cellular mobile users or fixed telephone users attempt to access the Internet. Each mobile or fixed telephone user has a respective mobile or fixed telephone number assigned. However, in order to access the Internet, the mobile or fixed telephone users also need an Internet address (normally obtained by a subscription to an Internet service). Currently, mobile or fixed telephones are not considered to be "devices" in the Internet. Users' mobile or fixed telephone numbers have no logical or physical connection with a device's Internet address. Consequently, the users have to manage for themselves in associating their individual telephone numbers with appropriate Internet addresses that can be used with their telephones. This problem will be compounded in the future, when telephone and computer functions are integrated to form a universal communication device, such as, for example, a particular radiotelephone being made by Telefonaktiebolaget LM Ericsson (publ). In order to keep pace with this emerging technology, it will be convenient (and thereby advantageous) to automatically match users' telephone numbers in the telecommunications domain with respective Internet addresses in the data communications domain.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a method and system that automatically matches a mobile or fixed telephone number with an Internet address.

It is another object of the present invention to provide mobile and fixed telephone users with convenient access to the Internet.

It is yet another object of the present invention to provide a matching of name identifiers between the data communication and telecommunications domains.

It is still another object of the present invention to provide more efficient mobile data services.

In accordance with the present invention, the foregoing and other objects are achieved by the use of an IP-Number Router/Gateway (ING), which functions as a distributed hierarchical name-matching and conversion global directory service database that enables mapping between telephone numbers and IP addresses, telephone numbers and device (host) names, telephone numbers and personal user names, and device (host) names and personal user names.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a block diagram that illustrates the use of an IP-number router/gateway, in accordance with a preferred embodiment of the present invention;

FIGURE 2 is a block diagram that illustrates additional details of the IP-number router/gateway shown in FIGURE 1;

FIGURE 3 is a block diagram of an exemplary embodiment of the IP-number router/gateway shown in FIGUREs 1 and 2; and

FIGURE 4 is a block diagram that illustrates an exemplary use for the IP-number router/gateway shown in FIGUREs 1, 2 and 3.

DETAILED DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the present invention and its advantages are best understood by referring to FIGUREs 1-4 of the drawings, like numerals being used for like and corresponding parts of the various drawings.

Essentially, in a broad sense, the present invention comprises an ING and a method of use. The ING functions preferably as a router or gateway and a distributed hierarchical name-matching and conversion global directory service database that enables a mapping between telephone numbers and IP addresses, telephone numbers and device names, telephone numbers and personal user names, and device names and personal user names. As such, telephone numbers can be used as virtual IP addresses for supporting data communications between the Internet and telephone networks.

More specifically, FIGURE 1 is a simplified block diagram that illustrates the basic functions of an ING, which can be used to implement a preferred embodiment of the present invention. As shown, the segment (10) to the left of the dashed vertical line represents the Internet or an IP network typically in a data communications domain, while the segment (20) to the right of the dashed line represents a mobile or fixed telephone network typically in a telecommunications domain. The ING (described in more detail below) is preferably a distributed, hierarchical name-matching and name-conversion facility (e.g., database with associated digital processor), which matches or converts (12) mobile or fixed telephone numbers 22 in the telecommunications domain with/to or from respective host or terminal names 14 in the data communications domain. Also as shown, the ING matches or converts (16) mobile or fixed telephone numbers 22 with/to or from IP addresses 18. As such, the ING functions as a router or gateway between the Internet and telephone networks. Consequently, telephone numbers can be used as virtual IP addresses for supporting data communications between the Internet and the telephone networks.

Additionally, as described earlier, on the data communications side, a host device (associated with host name 14) is located at a node on the Internet. A computer (or similar device) is assigned a unique IP address (18). The IP (protocol) uses the IP address to route packets of data from the host device to the computer (or similar device) having that unique address (18). The computer (or similar device) also has assigned a hardware or station address (19).

On the telecommunications side, a unique telephone number 22 is associated with a respective fixed or mobile telephone. If a mobile telephone moves into a network service area other than its home service area, it is assigned a temporary mobile station roaming number (MSRN) 24 associated with the new service area. Each mobile telephone also has an assigned hardware or station address 26. For example, in the digital cellular Global System for Mobile Communications (GSM), the station address for a mobile telephone is that mobile's International Mobile Station Equipment Identity (IMEI).

Additional aspects of the preferred embodiment of the present invention are shown in FIGURE 2. For example, in addition to the functionality shown in and described with respect to FIGURE 1, the ING (in accordance with the present invention) matches or converts a personal user name 28 (e.g., Lena Andersson) with/to or from a device's IP address 18 (via connection 29), host name 14 (via connection 31), or telephone number 22 (via connection 33). The matching or conversion between the personal user name and the device's IP address can be performed by the ING using, for example, a known associative data conversion or data matching routine (e.g., look-up table including personal user names and associated device IP addresses).

FIGURE 3 is a diagram that illustrates an implementation of the ING concept shown in and described with respect to FIGUREs 1 and 2. In this exemplary illustration, a host name (52) or IP address (54) input to the ING 50 results in a corresponding telephone number (56) being output from the ING. As such, the ING 50 is preferably implemented as one or more routers or gateways with a distributed database (not explicitly shown in FIGURE 3), with each database or database section located at a respective access point where a fixed or mobile telephone network is connected to the Internet.

Similar to the functionality of a Domain Name Server (DNS), the ING 50 can employ what is commonly referred to as a "client-server" methodology. In other words, preferably at the "root" server (or any appropriate server) of a DNS (100) in use, a telephone number domain entry (".tel") is maintained in a database record in a corresponding ING. In the example shown in FIGURE 3, the ".tel" domain entry is associated with a telephone number server 110. Also in the example shown, other

domain entries that can be maintained by the root server 100 are those associated with a server for entities located in Sweden (102), a server for commercial entities (104), a server for educational entities (106), and a server for Ericsson Telecom corporate entities located in Sweden (108). The ING 50 (associated with a DNS for this embodiment) includes a resolver (preferably implemented in software), which (in this exemplary embodiment) includes a plurality of library functions associated with the distributed database of the ING. For this embodiment, such a resolver includes five library functions. Each such library function performs one of the five matchings or conversions shown in and described with respect to FIGUREs 1 and 2 (i.e., 12, 16, 29, 31 and 33). Specifically, each such library function is used by the client part (associated with the DNS) of the client-server methodology to access the ING 50 at the appropriate access point. As described in more detail directly below, this access point is preferably at an input of a respective ING router or gateway.

FIGURE 4 is a diagram that shows an exemplary system that can be used to implement an ING and method of use, in accordance with a preferred embodiment of the present invention. In the example illustrated by FIGURE 4, the ING described hereinafter is implemented with respect to two mobile radio networks and one fixed telephone network. Specifically, system 200 includes an IP network or "Internet" 202 and a plurality of devices (e.g., computer terminals) 204 that are connected for two-way communications with the Internet. An ING (distributed as 50a, 50b, 50c, etc.) is connected to the Internet 202 at an access point for a respective mobile or fixed telephone network (206, 208, 210). A representative mobile radiotelephone 212 communicates with radio network 206 via a radio air interface. In this exemplary embodiment, radio network 206 is shown as a cellular GSM network, and radio network 208 is shown as a cellular Advanced Mobile Phone System (AMPS) network. A representative fixed telephone 214 communicates with Public Switched Telephone Network (PSTN) 210 via a wireline connection.

Referring to FIGUREs 3 and 4, each mobile phone (212) or fixed telephone (214) with data communications capability has an associated "telephone-name" that includes the suffix ".tel". This use of this suffix means that the mobile phone or fixed telephone resides in the telephone domain of the associated DNS. The telephone domain is subdivided into a plurality of sub-domains, such as, for example,

".gsm.mobile.tel" for GSM mobile phones, ".amps.mobile.tel" for AMPS mobile phones, or ".Stockholm.pstn.tel", for fixed PSTN telephones in the Stockholm, Sweden area. Preferably, an ING is associated with the sub-domains at this level and maintains these sub-domain names. Referring to FIGURE 3, the host name for mobile phone 212 (FIGURE 4) can be "ericsson1.gsm.mobile.tel", and the host name for fixed telephone 214 can be "ericsson2.ecn.pstn.tel".

In operation, in accordance with the present invention, a device in the data communications domain (e.g., computer 204) can send IP packets to any mobile phone or fixed telephone that has a data communications capability, by using the mobile phone or fixed telephone "telephone-name" in a similar manner as that used for sending IP packets with a host name. One method that can be used is to employ a resolver in the computer (e.g., 204). Essentially, such a resolver is a software program running on a terminal or a computer/client that can communicate with the ING (50), such as, for example, querying the ING, interpreting the results of the query, etc. Preferably, this resolver maintains the address of at least one DNS and/or ING (e.g., 50a, 50b, 50c, etc.) and can direct packet transmission requests to that specific DNS and/or ING. Using the information in the "telephone-name" of the destination mobile phone or fixed telephone, that specific DNS and/or ING forwards the packet transmission request to the correct ING at the access point where the appropriate mobile or fixed telephone network is connected to the Internet.

For example, if computer 204 were to send a packet request to the Ericsson1 mobile phone (212), the user of computer 204 could input a telephone number for that destination phone (e.g., "+46-70-568 1833"). In this case, the sender would be using the telephone number as an IP destination address. The resolver in the computer (204) would convert that particular telephone number to a corresponding "telephone-name" ("ericsson1.gsm.mobile.tel"). The router that initially receives the IP packet sent from computer 204 determines that the destination address being used is not a normal IP address. Consequently, that router forwards the IP packet preferably to the nearest ING router or gateway (e.g., at PSTN ING 50c), which (with knowledge of the appropriate "telephone-name") forwards the IP packet to the appropriate ING router or gateway associated with the GSM network ING 50a. That ING router or gateway (50a) forwards the IP packet to the GSM network 206 and on to the appropriate mobile

phone 212.

Alternatively, the output of an ING can be an IP address of a particular ING router or gateway. In this case, the user can input an IP address to computer 204, in order to send an IP packet to the appropriate ING router or gateway. That ING router or gateway can convert the IP address into a corresponding telephone number for the destination phone and use the telephone number (or other appropriate means, such as an X.25 address, internal address, temporal address, etc.) to direct the IP packet to the correct phone.

Although a preferred embodiment of the method and apparatus of the present invention has been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

WHAT IS CLAIMED IS:

1. A communication system, comprising:

a first communication network, including a first set of identifiers;

a second communication network, including a second set of identifiers; and

an identifier resolver coupled to said first communication network and said second communication network.

2. The communication system according to Claim 1, wherein at least one of said first set of identifiers is conveyed to said identifier resolver from said second communication network, for routing to said first communication network.

3. The communication system according to Claim 1, wherein said identifier resolver is operable to use an identifier from said second set of identifiers to communicate in said first communication network.

4. The communications system according to Claim 1 or 2, wherein said first communication network comprises an internet, and said second communication network comprises a telephone network.

5. The communication system according to Claim 1 or 2, wherein said first communication network comprises a telephone network, and said second communication network comprises an internet.

6. The communication system according to Claim 1, wherein said first set of identifiers comprises telephone numbers.

7. A system for communicating between a terminal on an internet and a telephone, comprising:

storage means for storing a first identifier associated with said terminal;

conversion means coupled to said storage means, for converting said first identifier to a second identifier associated with said telephone; and

routing means coupled to an output of said conversion means, for routing

communications between said terminal and said telephone using said second identifier.

8. The system of Claim 7, wherein said storage means, conversion means, and routing means comprise an IP-number router/gateway.

9. The system of Claim 7, wherein said conversion means comprises a lookup table.

10. The system of Claim 7, wherein said routing means comprises a distributed database.

11. A system for communicating between a terminal on an internet and a telephone, comprising:

storage means for storing a first identifier associated with said terminal and a second identifier associated with said telephone;

conversion means coupled to said storage means, for converting between said first identifier and said second identifier, and between said second identifier and said first identifier; and

routing means coupled to an output of said conversion means, for routing communications between said terminal and said telephone, or said telephone and said terminal, using at least one of said first identifier and said second identifier.

12. The system of Claim 11, wherein said routing means comprises an IP-number router/gateway.

13. A method for communicating between a terminal on an internet and a telephone, comprising the steps of:

inputting an identifier associated with said telephone;

matching said identifier with at least one of a predetermined internet protocol address and predetermined host name associated with said terminal; and

routing communications between said telephone and said terminal using said at least one of a predetermined internet protocol address and predetermined host name.

14. The method of Claim 13, wherein said internet comprises a world-wide web.

15. The method of Claim 13, wherein said telephone comprises a mobile telephone.

16. The method of Claim 13, wherein said telephone comprises a fixed telephone.

17. The method of Claim 13, wherein said identifier comprises a personal user name.

18. The method of Claim 13, wherein said identifier comprises a telephone number.

19. The method of Claim 13, wherein said matching and routing steps are performed by an IP-number router/gateway.

20. A method for communicating between a terminal on an internet and a telephone, comprising the steps of:

inputting a first identifier associated with said terminal;

matching said first identifier with a second identifier associated with said telephone; and

routing communications between said terminal and said telephone using said second identifier.

21. The method of Claim 20, wherein said first identifier comprises a host name.

22. The method of Claim 20, wherein said first identifier comprises an internet protocol address.

23. The method of Claim 20, wherein said second identifier comprises a personal user name.

24. The method of Claim 20, wherein said second identifier comprises a telephone number.

25. The method of Claim 20, wherein said telephone comprises a mobile telephone.

26. The method of Claim 20, wherein said telephone comprises a fixed telephone.

27. The method of Claim 20, wherein said matching and routing steps are performed by an IP-number router/gateway.

28. The method of Claim 20, wherein said communications comprises packet data.

29. A method for communicating between a terminal on an internet and a telephone, comprising the steps of:

inputting a first identifier associated with said terminal;

inputting a second identifier associated with said telephone;

matching said first identifier with said second identifier, or said second identifier with said first identifier; and

routing communications between said terminal and said telephone using said matching said first identifier with said second identifier, or said second identifier with said first identifier.

30. The method of Claim 29, wherein said routing step is performed by an IP-number router/gateway.

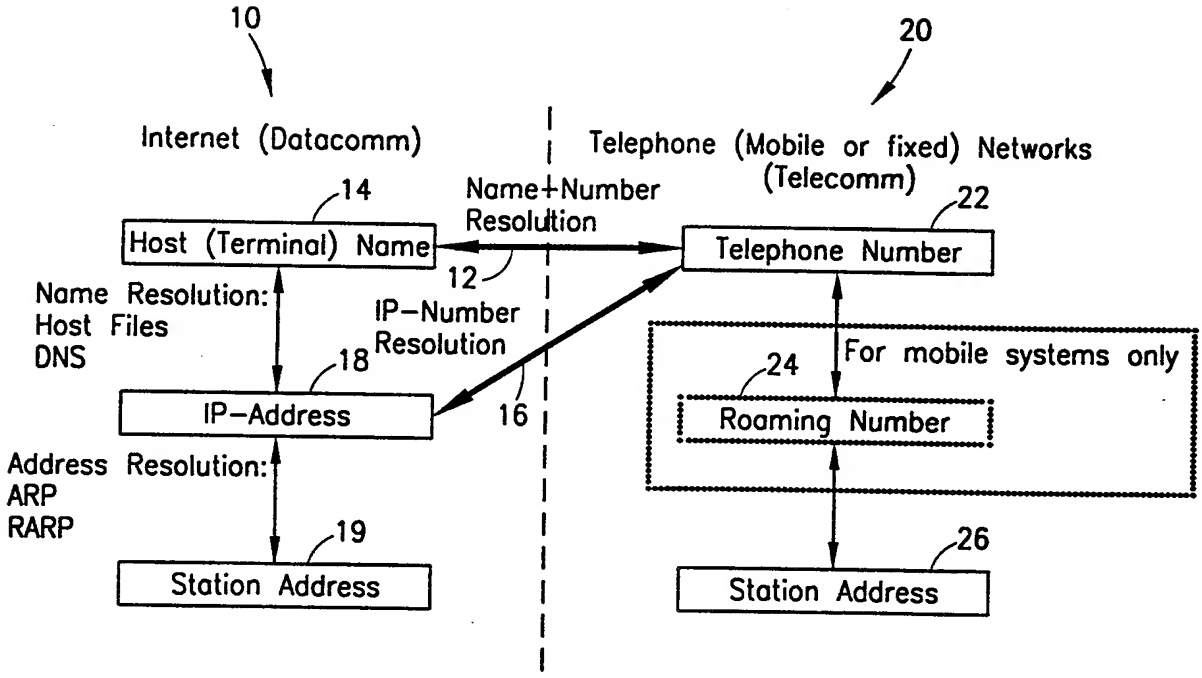

10
20
Internet (Datacomm)
Telephone (Mobile or fixed) Networks (Telecomm)
14
Name+Number Resolution
22
Host (Terminal) Name
12
Telephone Number
Name Resolution: Host Files DNS
IP-Number Resolution
18
24
For mobile systems only
IP-Address
16
Roaming Number
Address Resolution: ARP RARP
19
26
Station Address
Station Address

FIG. 1

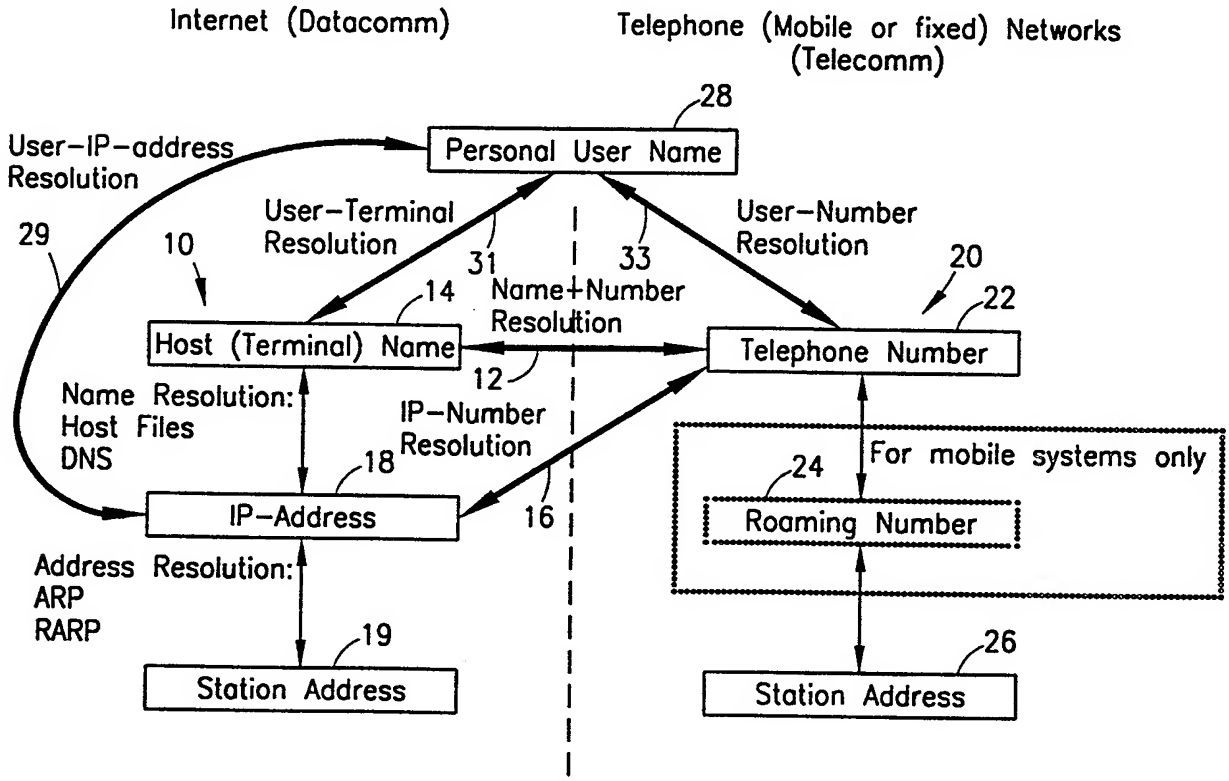
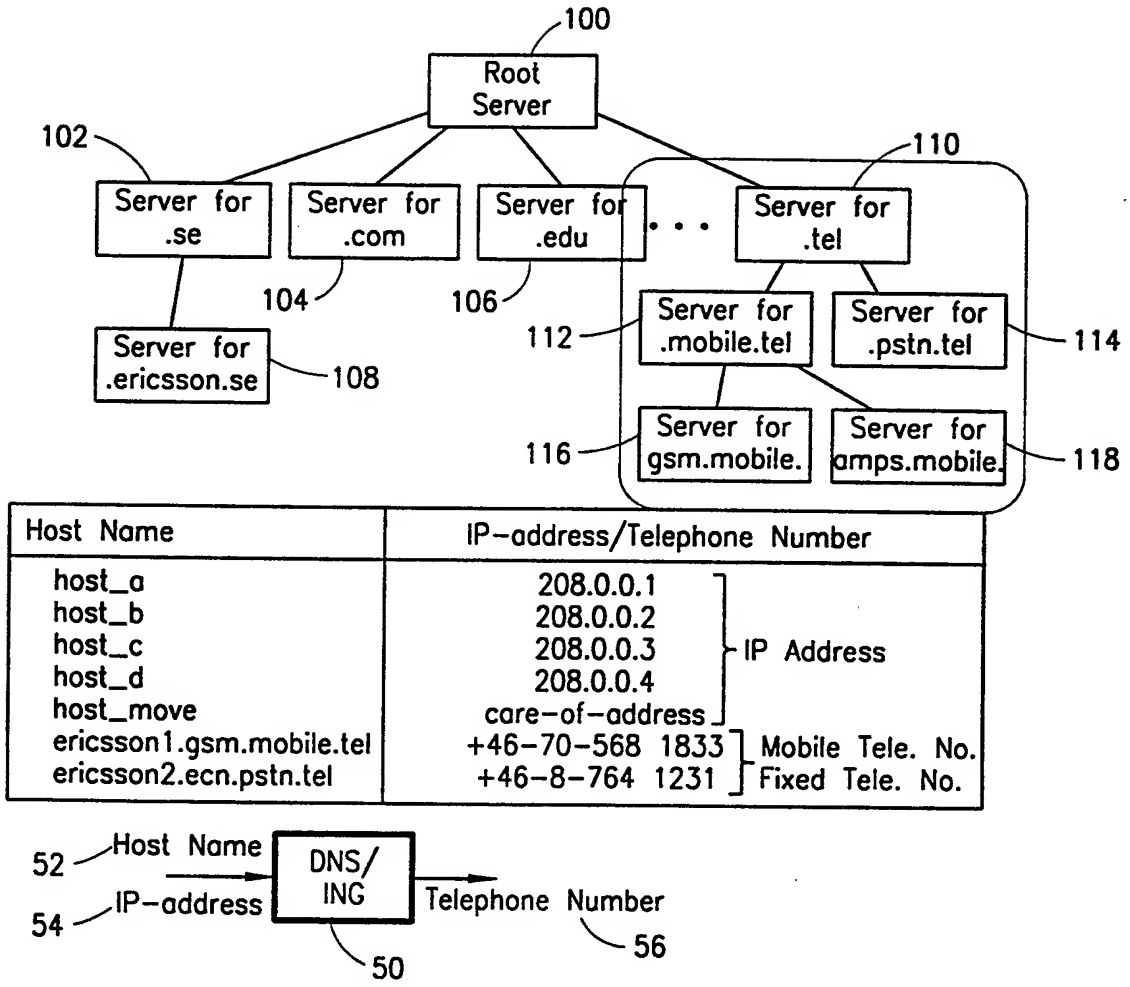

Internet (Datacomm)
Telephone (Mobile or fixed) Networks (Telecomm)
28
Personal User Name
User-IP-address Resolution
29
User-Terminal Resolution
31
33
User-Number Resolution
10
20
14
Name+Number Resolution
22
Host (Terminal) Name
12
Telephone Number
Name Resolution: Host Files DNS
IP-Number Resolution
18
24
For mobile systems only
IP-Address
16
Roaming Number
Address Resolution: ARP RARP
19
26
Station Address
Station Address

FIG. 2



Host Name	IP-address/Telephone Number	
host_a	208.0.0.1	IP Address
host_b	208.0.0.2	
host_c	208.0.0.3	
host_d	208.0.0.4	
host_move	care-of-address	
ericsson1.gsm.mobile.tel	+46-70-568 1833	Mobile Tele. No.
ericsson2.ecn.pstn.tel	+46-8-764 1231	Fixed Tele. No.

FIG. 3

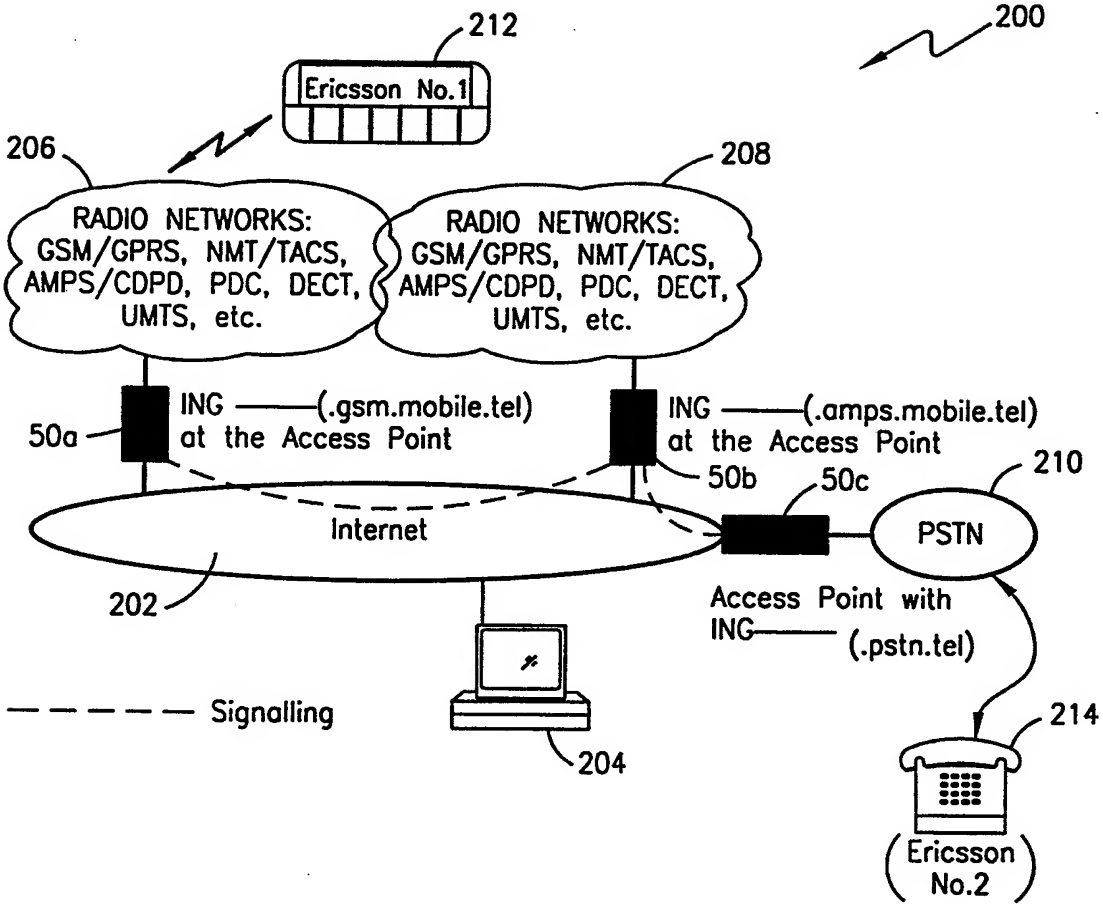

212
200
Ericsson No.1
206
208
RADIO NETWORKS: GSM/GPRS, NMT/TACS, AMPS/CDPD, PDC, DECT, UMTS, etc.
RADIO NETWORKS: GSM/GPRS, NMT/TACS, AMPS/CDPD, PDC, DECT, UMTS, etc.
50a
ING (.gsm.mobile.tel) at the Access Point
ING (.amps.mobile.tel) at the Access Point
50b
50c
210
Internet
PSTN
202
Access Point with ING (.pstn.tel)
Signalling
204
214
Ericsson No.2

FIG. 4

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/SE 98/02394

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04M7/00 H04L12/64 H04L12/66 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04M H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 812 085 A (NIPPON TELEGRAPH & TELEPHONE) 10 December 1997 see abstract see page 2, column 2, line 42 - page 3, column 4, line 11 see page 5, column 7, line 15 - page 6, column 10, line 22	1-30
X	US 5 621 727 A (VAUDREUIL GREGORY M) 15 April 1997 see column 34, line 57 - column 36, line 11 see figures 17,18	1-30
X	WO 97 20442 A (ERICSSON TELEFON AB L M) 5 June 1997 see page 5, line 20 - page 10, line 3	1-30

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
22 March 1999	31/03/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Megalou, M

1

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Int onal Application No
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